# MODE III DYNAMIC CRACK GROWTH WITH A RATE DEPENDENT COHESIVE ZONE AND A COMBINED CRITICAL STRESS-COD CRITERION

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The steady state dynamic propagation of a crack in a isothermal linear elastic body is numerically simulated. Specifically, a mode III semi-infinite crack with a nonlinear rate dependent cohesive zone is assumed to propagate from rest in an unbounded homogeneous linear elastic continuum due to the application of loads distributed on a fixed region of the crack faces. The numerical results are obtained via a semi-analytical technique based on complex variables and integral transforms. The main focus of the paper will be the prediction of the crack motion as it results from the application of a fracture criterion which allows for fracture to occur when a specified critical crack opening displacement (CCOD) is achieved or when a critical value of the cohesive stress is achieved.

This paper intends to explore a conjecture made by the authors in previous papers [1,2] according to which, by some reasonable assumptions concerning the cohesive zone constitutive properties, a continuum theory of dynamic crack propagation can predict motions with a an effective crack speed which oscillates rapidly and that may lead to the formation of periodic microstructures on the post-mortem crack surfaces. To date, this type of instability has been predicted only via atomistic simulations (cf., for example, [3]).

## References

[1] F. Costanzo and J. R. Walton, "Numerical Simulations of a Dynamically Propagating Crack with a Nonlinear Cohesive Zone," *International Journal of Fracture*, v. 91, pp. 373–389, 1998.

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[3] M. Marder and S. P. Gross, "Origin of Crack Tip Instabilities", *Journal of the Mechanics and Physics of Solids*, v. 43, pp. 1–48, 1995.